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Observations on *Tylenchus musicola* Cobb, 1919, from diseased Banana Roots.

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In March, 1928, Mr. S. F. Ashby of the Imperial Bureau of Mycology, sent the writer some portions of diseased banana roots for examination and determination of the nematodes occurring therein. The material had come from plants growing in the Palm House at the Royal Botanic Gardens, Kew, where bananas of several species had been growing for some years in the same soil. Information was later sent that the plants had been in failing health for the last two or three years and that this year the symptoms of disease had become acute. These symptoms were said to be quite similar to those described by Nowell (1919) in the case of diseased " bluggoe " banana in Grenada with which *Tylenchus musicola* was found to be associated.

The material arrived in a fresh condition and was mainly of a dull blackish brown colour and comparatively soft. A small portion of it was teased up in water when specimens of *Tylenchus musicola* and of one or two other kinds of nematodes were obtained from the soft cortical tissues. The bulk of it was cut into small pieces and extracted by the Baermann method with cold water and by this means numbers of *T. musicola* were obtained. They were much more numerous than any other kind of nematode obtained from the material.

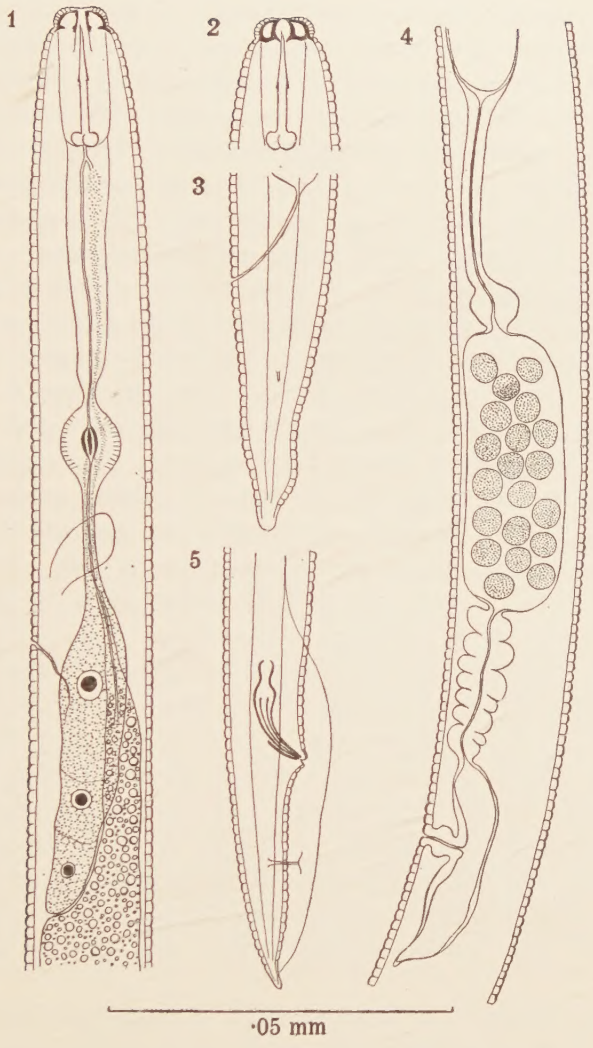
Tylenchus musicola has been recorded twice previously ; first by Cobb (1919) from roots of the " bluggoe " banana and recently by Steiner (1927) from vine roots. Cobb's material was preserved in 70 per cent. alcohol and Steiner's reached him in a dried condition, the worms being obtained by soaking in water. The writer has been fortunate in obtaining living worms from fresh material and the detailed structure of these has been studied in the living condition and immediately after killing by heat. Many of them were fixed by Ditlevsen's mixture and finally mounted in weak glycerine. In the main, the writer's observations confirm those of Cobb's original description, whilst they throw additional light on certain details which have not been fully made out by previous investigators.

Morphology.

Principal measurements.—Length, female, 0·64 mm. to 0·68 mm ; male, 0·55 mm. to 0·57 mm. Width, female, 0·02 mm. to 0·025 mm ; male, 0·017 mm. to 0·02 mm. ; stylet, 0·017 mm. ; anterior end to posterior side of œsophageal bulb, 0·07 mm. to 0·073 mm. ; anterior end to posterior end of salivary glands, 0·135 mm. to 0·14 mm. ; anterior end to vulva, 0·46 mm. to 0·5 mm. ; anus to tip of tail, female and male, 0·035 mm. ; spicules, 0·015 mm.

The cuticle is transversely striated with coarse striæ which, however, do not cross the rather prominent lateral fields. The body tapers slightly anteriorly and posteriorly and is comparatively stout in proportion to the length in both sexes. The head which also carries transverse striæ, is rather flat and is limited behind by a shallow encircling groove. The accompanying illustrations show that it is supported by a strongly cuticularised framework having the appearance shown in fig. 2 when seen in surface view. From this it seems clear that it is formed from six lips fused together. When viewed in optical section (see fig. 1) it can be seen that the head framework forms an almost cylindrical buccal cavity the walls of which have small lateral thickenings immediately inside the oral opening and at the level of the posterior limit of the head. Following this they are continued backward as somewhat fainter lines to a distance practically equal to the depth of the head.

The stylet is large and is composed of an anterior conical part about equal in length to the cylindrical posterior part on to which it fits. The basal swellings are large and prominent. Both Cobb and Steiner speak



Tylenchus musicola Cobb, 1919.

Fig. 1.—Anterior end of a worm drawn in optical section. Fig. 2.—Surface view of head region. Fig. 3.—Female tail. Fig. 4.—Portion of female gonad. Fig. 5.—Male tail. All drawings made under oil-immersion to the same scale of magnification.

of the somewhat "ghostly" appearance of the second part of the stylet and the swellings but this is probably because they only examined preserved specimens; in the fresh state the whole stylet is a remarkably distinct and refractive structure. It is surrounded by a clear zone probably composed of muscles attached to its base. The outlines of this zone pass into those of the anterior part of the œsophagus. The latter gradually decreases in diameter towards the muscular bulb immediately anterior to which it constricts to a narrow neck. This constriction was found to be a constant feature in all the specimens examined. The bulb is rather small and is succeeded by a slender part crossed by the nerve ring posterior to which the œsophagus gives off the salivary glands and gradually merges into the intestine. The salivary glands were not clearly made out by Cobb and Steiner. They are three in number, lying together in a compact mass, but the faint indications of the separate cells can be distinguished under the oil-immersion. The anterior cell is rather larger than the other two and in each a distinct nucleus can be seen. As fig. 1 shows the glands are situated ventro-laterally in the body with the posterior end close to the ventral side of the body. It has been found difficult to trace the course of the outlets from the glands but apparently there are two openings into the lumen of the œsophagus at the posterior end of the crescentic lining of the muscular bulb and a strand of granular material passes through the bulb, along the dorsal side of the anterior part of the œsophagus and opens by a short duct close to the base of the stylet. The excretory pore is situated a short distance posterior to the level of the nerve ring. The beginning of the intestine is overlaid by the salivary glands. It is quite narrow at the level of the excretory pore, but widens gradually until the posterior end of the glands is reached when it expands and occupies the width of the body. Its walls contain large numbers of fatty reserve food globules of various sizes.

Female characters.—The vulva, situated at about two-thirds of the body length from the anterior end has fairly prominent lips and the vagina which has thickened walls leads inwards at right angles to the body surface. It opens into a rather shallow uterine cavity, the walls of which are refractive in appearance. Posteriorly there is a short uterine sac about as long as the body is wide at this point. Anteriorly the cavity is a little shorter than the posterior one. It narrows down and leads into a muscular

portion with convoluted walls. This then expands into a well-defined, almost cylindrical receptaculum seminis which in most of the examples examined was filled with spherical sperms. In front of this there is another fairly thick walled oviduct which leads to the ovary. The latter is rather short and does not extend more than about half the distance from the vulva to the salivary glands. None of the worms examined showed ripe ova.

The shape of the female tail is an important character in that it differentiates this species from another root infesting member of genus, *Tylenchus pratensis* in which there is little tapering behind the anus and the tip is broad and bluntly rounded. Cobb has shown that in *T. musicola* the tip of the tail is rather variable in shape. In the specimens examined by the writer the majority had a shape like that shown in fig. 3. There is a good deal of tapering behind the anus and just anterior to the tip the dorsal side swells outward with a slighter corresponding inward curve on the ventral side the two sides then uniting to form a rather stout peg-like tip. On either side of the tail at about half-way between the level of the anus and the tip there is a fine lateral papilla arising from the lateral line and proceeding to a small pit in the cuticle.

Male characters.—The male tail tapers considerably behind the anus to a fairly sharp point. On each side of the body there is a caudal ala which arises in the region of the ventral margin of the lateral field some distance anterior to the forward end of the spicules and joins the body just in front of the tip of the tail. There is a single pair of caudal papillæ or bursal ribs situated about halfway between the anus and the end of the tail which arise, one on either side, from the lateral line and run outwards to about half the depth of each wing where the point lies in a shallow depression. The spicules are paired and each is shaped as in fig. 5.

The small slightly swollen head is followed by a constriction after which the spicule expands and attains its greatest width and then gradually tapers to a narrow point. There is a simple gubernaculum which is about one-third the length of the spicules.

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